US009487308B2

(12) **United States Patent**
Featherstone et al.

(10) **Patent No.: US 9,487,308 B2**
(45) **Date of Patent: Nov. 8, 2016**

(54) **LAUNCH VEHICLES WITH RING-SHAPED EXTERNAL ELEMENTS, AND ASSOCIATED SYSTEMS AND METHODS**

(71) Applicants: **Mark Featherstone**, Issaquah, WA (US); **John Michael Sanders**, Sammamish, WA (US); **Roger E. Ramsey**, Renton, WA (US); **Eric David Wetzel**, Seattle, WA (US)

(72) Inventors: **Mark Featherstone**, Issaquah, WA (US); **John Michael Sanders**, Sammamish, WA (US); **Roger E. Ramsey**, Renton, WA (US); **Eric David Wetzel**, Seattle, WA (US)

(73) Assignee: **Blue Origin, LLC**, Kent, WA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 464 days.

(21) Appl. No.: **13/833,985**

(22) Filed: **Mar. 15, 2013**

(65) **Prior Publication Data**

US 2014/0263841 A1 Sep. 18, 2014

(51) **Int. Cl.**
B64G 1/00 (2006.01)
B64G 1/14 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***B64G 1/002*** (2013.01); ***B64G 1/14*** (2013.01); ***B64G 1/222*** (2013.01); ***B64G 1/402*** (2013.01); ***B64G 1/62*** (2013.01); ***F42B 10/02*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC . B64C 2201/18; B64C 39/06; B64C 39/062; B64G 1/00; B64G 1/002; B64G 1/62; B64G 1/641; B64G 1/645
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,464,827 A 3/1949 Noyes et al.
2,824,711 A * 2/1958 Porter G01M 9/00 244/3.21
(Continued)

FOREIGN PATENT DOCUMENTS

RU 2088787 8/1997
WO WO 2010099228 A1 * 9/2010 ..... B65G 1/002
(Continued)

OTHER PUBLICATIONS

Bill Gunston; The Cambridge Aerospace Dictionary; 2009; Cambridge University Press.*
(Continued)

Primary Examiner — Tien Dinh
Assistant Examiner — Michael A Fabula
(74) *Attorney, Agent, or Firm* — Perkins Coie LLP

(57) **ABSTRACT**

Launch vehicles with ring-shaped external elements, and associated systems and methods. A representative aerospace system includes a launch vehicle having a first end and a second end generally opposite the first end, with the launch vehicle being elongated along a vehicle axis extending between the first and second ends, and having an external, outwardly facing surface. The system can further include an annular element carried by the launch vehicle, the annular element having an external, inwardly-facing surface radially spaced apart from, and extending at least partially circumferentially around, the vehicle axis. The annular element can have a first edge surface facing a first direction along the vehicle axis, and a second edge surface facing a second direction along the vehicle axis, the second direction being opposite the first direction. A propulsion system can be carried by the launch vehicle, and can have at least one nozzle positioned toward the first end of the vehicle to launch the vehicle. A controller can be in communication with the launch vehicle and programmed to direct the vehicle in the first direction during vehicle ascent, and in the second direction during vehicle descent.

43 Claims, 16 Drawing Sheets